The Canadian Entomologist

VOL. LVII. ORILLIA, NOVEMBER, 1925. No. 11

THE FACTORS DETERMINING THE DISTRIBUTION OF NORTH AMERICAN BARK-BEETLES.*

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The distribution of the species of the family Ipidae throughout the world is apparently governed chiefly by the distribution of the host trees to which the species are confined and by the different climatic conditions. A greater number of the genera inhabit the tropics, a smaller number are confined to the colder zones, while many genera and species are abundant in the warm temperate zones and extend to varying distances into the north or south. In North America the number of species decreases very rapidly in passing from the Austral Life Zone northward through the Transitional and into the Canadian Zone.

The distribution of the family in North America is illustrated fairly well by the genus *Dendroctonus*. All the members of that genus, with the exception of the single European species *micans*, inhabit the coniferous forests of this continent, occurring from the neighborhood of the Arctic circle to the forests of Central America.

THE DISTRIBUTION OF THE SPECIES

Dendroctonus valens Lec., a reddish species, breeds in healthy and dying pines and spruces throughout the Canadian and Transition Zones from northern Canada to Mexico and Guatamala. It is not recorded from the Hudsonian Zone nor, apparently, from the Lower Austral and the southern part of the Upper Austral Zones. It, therefore, appears to be limited by extreme cold in the north and by high temperatures in the south. The influence of climate in its distribution in the southern part of its range may be chiefly in limiting the distribution of the host trees.

Dendroctonus terebrans Oliv., a blackish species, replaces *valens* Lec., from which it is barely distinct, in the southern Carolinian and Austroriparian Zones. It breeds in *Pinus taeda, Pinus palustris,* and other southern pines, but also in *Pinus strobus* and *Picea rubens* in the tongue of the Transitional Zone extending through the uplands of West Virginia and Virginia. It is probable that its distribution is limited by preference for a warmer climate rather than by a choice of food plants.

Dendroctonus frontalis Oliv. breeds in southern pines throughout practically the same area as *terebrans* and its distribution is probably limited by the same factors. It is also reported to occur in the northern trees, *Pinus strobus* and *Picea rubens,* in Virginia and West Virginia.

Dendroctonus piceaperda Hopk. breeds throughout the North Eastern States, Eastern Canada and Newfoundland in *Picea canadensis, P. rubens* and *P. mariana.* It breeds usually only in the larger mature trees and is abundant only in mature spruce forests. It is apparently not abundant in the black spruce

*—Contribution from Division of Forest Insects, Entomological Branch, Department of Agriculture, Ottawa.

forests of Western Quebec and Northern Ontario; but it has occurred in extensive outbreaks in the large white spruce of Northern Manitoba, Northern Saskatchewan, the Algoma District of Ontario, the Gaspe Peninsula of Quebec, New Brunswick, Maine, and Newfoundland. It has not been recorded from the Hudsonian Zone.

Dendroctonus borealis Hopk. breeds in *Picea canadensis* and *Picea engelmanni* from Alaska and Yukon southward through the interior of British Columbia and throughout the Rocky Mountain Region of the United States. It extends into Northern Alberta and is indistinguishable from *piceaperda* of Northern Manitoba, and Saskatchewan. We have probably to deal with one species, *piceaperda,* covering an immense area in the spruce forests of the Canadian and Transition Zones. It attacks healthy trees as well as those in a dying condition, affects all species of *Picea* in its range, and is apparently limited in distribution only by the extreme cold of the subarctic regions and the high temperatures of the lowlands of the south.

Dendroctonus obesus Mannh. breeds in Sitka spruce along the Pacific coast. It is a black species with many lighter colored individuals which are often difficult to separate from *borealis* and *piceaperda.* It may be considered as limited to the moist Pacific coast slope and the range of its single host tree.

Dendroctonus brevicomis Lec. breeds, in British Columbia, only in *Pinus ponderosa,* and is limited to the range of its single host tree. In the United States, it breeds also in Coulter pine and is likewise more abundant. *D. barberi* is barely distinct from *brevicomis* and extends its range southward into Mexico.

Dendroctonus monticolae Hopk. causes extensive outbreaks in British Columbia in *Pinus ponderosa, Pinus monticola* and *Pinus contorta,* and extends throughout the southern part of the Province and throughout the Western United States. It, apparently, does not occur far north of the railway belt in British Columbia nor on the eastern slope of the Rockies in Alberta, although lodgepole pine is very abundant on those areas. Since it occurs abundantly in western white pine in the British Columbia coast region, it is not checked by very moist conditions, and its distribution may be limited by the low winter temperatures of Northern British Columbia and the summits of the Rockies. It is notable that development of this and the preceding species was apparently checked in Central British Columbia following the excessively wet autumn of 1915 and the unusually cold winter of 1915-1916. *Dendroctonus ponderosae* Hopk. is barely distinct from *monticolae* and extends its range southward to or into Mexico.

Dendroctonus jeffreyi Hopk. is confined, almost entirely, to the state of California, and probably to the single host, *Pinus jeffreyi.* In this case the choice of a single host appears to be the limiting factor.

Dendroctonus johanseni Sw. is known only from the most northern white spruce of the Coppermine River and Alaska, and from one collection from white spruce in the Algoma District of Ontario. All our collections in the region just north of the prairies have failed to reveal any trace of it. Its only allies are *D. punctatus,* known through only a few specimens from the Eastern States, and *D. micans* of Europe. It is apparently confined to the Hudsonian and Canadian zones and almost exclusively to the extreme north. If it prefers the excessive cold of the Northern Hudsonian it is peculiar that on the first occasion of its

collection practically all the specimens, about 60 in number, had died shortly after transformation, with no cause suggested other than extreme cold.

Dendroctonus simplex Lec. breeds only in *Larix americana* and extends, probably, throughout the limit of its host in the United States and Canada, from the Atlantic coast to the Yukon and northern British Columbia.

Dendroctonus pseudotsugae Hopk. breeds only in *Larix occidentalis* and in *Pseudotsuga* and probably extends throughout the limits of those trees in British Columbia and the United States. We have no record of its occurrence on the eastern slopes of the Rocky Mountains in Alberta. There is a wide gap between the northern limit of Western Larix and Pseudotsuga and the southern limit of *Larix americana* in northern British Columbia; and a very narrow gap, less in some places than 25 miles, between their limits in the eastern foothills of the Rockies. It is possible that *simplex* and *pesudotsugae* would extend to each others hosts if the opportunity offered. The distribution of *D. pseudotsugae* is, therefore, apparently limited by the lack of suitable host trees to the northward and eastward of its range.

D. convexifrons Hopk., *D. arizonicus* Hopk.; and *D. approximatus* Dietz. occur in Western Yellow Pine in the dry region of south-western United States and possibly extend into Mexico. These species have spread northward into Utah and Colorado, checked in their northward distribution in the latter State presumably by climatic conditions, and have apparently been prevented from extending westward by the Mohave and Colorado deserts and the arid region of eastern California and Nevada.

Dendroctonus mexicanus and *D. parallelicollis* are Mexican species and *D. adjunctus*, about which little is known, occurs in Guatamala.

THE FACTORS INFLUENCING DISTRIBUTION.

The chief factors affecting the distribution of these beetles appear to be: the range and supply of their food trees, climatic conditions, natural barriers, food and breeding habits of the species, parasites and predators.

Range of Host Trees.

Dentroctonus simplex appears to follow its host tree, *Larix americana* throughout its range, but little influenced by other major limiting factors. *D. brevicomis* follows its chief host, *Pinus ponderosa*, throughout the greater part of its range, but is apparently restrained from the northern limit of *ponderosa* by the lower temperatures. *Dendroctonus valens* breeds in pine and spruce throughout the Canadian and Transition Zones of the Continent except that it is replaced in the Carolinian and Austoriparian sections by the very closely allied, melanic form *terebrans*. It seems probable that the distribution of its host trees determines the range of *valens*, except that it apparently does not follow *Picea* into the far north. Many species outside of the genus *Dendroctonus*, such as *Leperisinus aculeatus* Say, *Chramesus icoriae* Lec., and many others, follow their particular food plants throughout their ranges.

Climate.

Climate has unquestionably a very important influence upon many species. *Dendroctonus frontalis* and *D. terebrans* breed in southern pines, but occur in *Pinus strobus* and *Picea rubens* in Virginia and West Virginia. They do

not, however, follow those northern trees up into the Transition Zone, and are presumably unable to withstand the colder climate.

Dendroctonus monticolae follows the Transition Zone very closely throughout British Columbia and the Western United States, but, although it breeds in *Pinus contorta* in southern British Columbia, it does not follow the continuous forests of that timber into the colder areas of northern British Columbia and Alberta, and it is not yet known, to us, on the eastern slopes of the Rocky mountains in Alberta. In this case, climate appears to be the most important factor. *Dendroctonus obesus* appears to be limited to the range of its host, *Picea sitchensis*, but, on the other hand, this species is barely distinct from *borealis*, and may be a melanic form induced by the moist climate of the Pacific slope. *Dendroctonus johanseni* is known at present from only the three northern regions already mentioned; one collection on the Coppermine River at the northern limit of white spruce, one collection from Alaska, and one from the eastern shore of Lake Superior, and it is evidently the only species of *Dendroctonus* able to endure the very severe winters of the Hudsonian Zone. Three other bark-beetles were associated with *Dendroctonus johanseni* in its occurrence on the Coppermine River, *Polygraphus rufipennis* Ky., *Pityophthorus nitidus* Sw., and *Carphoborus andersoni* Sw.; the two first occurring throughout the Hudsonian and Canadian Zones, the last known only from that single collection.

Many other instances in the family could be cited to emphasize the apparently important effect of climate in determining the range of these beetles. Very many species, for example, have the upper Austral as the northern or southern limit of their range.

The influence of climate in determining the distribution of the host trees apparently affects indirectly the distribution of many species.

Barriers.

Barriers apparently influence the distribution of several species. The Great Plains limits many species to the east or to the west through an absence of their food plants, over a great part of the central area. It has already been remarked that *Dendroctonus pseudotsugae* Hopk., is limited northward and eastward by an absence of suitable hosts, and the summits of the Rocky Mountains may be an effective barrier for *D. monticolae* Hopk. The apparent effect of the Great American desert in limiting the distribution of species on either side of it has already been noted. *Ips knausi* Sw. is known only from the isolated forest region about Cloudcroft, N. Mex. A barrier in these instances is resolved into climatic conditions with or without a resulting absence of food plants.

Habits.

Food habits and breeding habits have a very important influence upon the distribution of many species. *Dendroctonus piceaperda, Dendroctonus monticolae, Dendroctonus brevicomis, Dendroctonus valens and Dendroctonus frontalis* attack and kill or breed successfully in living trees, and also, with equal readiness, inhabit dying bark; consequently, they are usually enabled to find an abundant supply of food material and on occasion to breed and spread very rapidly. *Dendroctonus murrayanae* and *Dendroctonus rufipennis*

apparently do not ordinarily attack healthy trees, but select bark in a dying condition. These species are usually not at all abundant and their insistence on bark in a certain weakened condition is probably responsible, in part, for their rarity. It is true of many bark-boring species that if the bark is not in a suitable condition the mortality among the progeny is very high. On the other hand, *Dendroctonus simplex*, which usually breeds in dying larch, obtains sufficient suitable bark and breeds so abundantly that it has spread throughout the whole of the enormous range of its host tree.

The number of eggs deposited and the number of broods developed each season affect the rate of multiplication, and therefore, in some measure, the distribution of the species. Many species of *Ips* and *Pityogenes* occur in very great numbers, not only on account of the abundance of suitable food material, but also because, under favorable circumstances, they are able to produce two or more broods each season. The individuals of many species, in both the *Hylesiniae* and the *Ipinae*, excavate two sets of egg-tunnels and lay two lots of eggs. These species, on this account, have available to them a more extensive and certain supply of food material.

On several occasions great flights of bark-beetles have been known to cross several miles of country, and shorter flights are not uncommon. It is obvious that a migrating habit would aid greatly in distributing the species.

Parasites.

Parasites and predators have a marked effect in checking the increase of a few species of *Dendroctonus* and of many other species in the family. *Dendroctonus pseudotsugae* and *Dendroctonus simplex* are often heavily parasitized by Hymenoptera. Clerid beetles destroy many adult bark-beetles during the short migrating season and have an important effect in reducing bark-beetle outbreaks in western pines. Woodpeckers often obtain immense numbers of the young broods by stripping the bark from standing infested trees. It appears that the work of the woodpeckers may have an important effect in reducing outbreaks of *Dendroctonus piceaperda* in Eastern Quebec, Northern Ontario and in the northern parts of Manitoba and Saskatchewan.

Artificial distribution not infrequently occurs, particularly when a large number of infested logs is brought into the neighborhood of suitable food trees; several instances of this have been known to occur. *Eccoptogaster multistriatus* and *Xyleborinus saxesceni* have been transferred from Europe to America, presumably in the bark or wood of their host trees, and a similar distribution from one part of America to another has probably occurred in recent years.

An abundant and continuous supply of suitable food material is always one of the most important factors in distribution, and we find that the presence of extensive windfalls or light ground fires, by which the trees are killed without much injury to the bark, has a great effect in enabling a rapid multiplication of these beetles to occur and so must also influence their distribution.

Certain species, such as *Dendroctonus valens, Polygraphus rufipennis, Dendroctonus simplex*, species of *Pityophthorus, Leperisinus aculeatus*, and many others, are apparently able to adapt themselves to various climatic conditions,

and, having an abundant and widely distributed supply of suitable food material available to them, are enabled to spread over very large areas. Other species, of the genera *Dendroctonus, Ips, Phloeosinus, Stephanoderes, Hypothenemus, Xyleborus, Scierus* and many others, are apparently limited, chiefly by temperature conditions, to either the northern or, more commonly, to the southern part of the continent. A few species probably favor a moist climate and are peculiar to either the Atlantic or Pacific coastal regions, or prefer a dry climate and are thereby limited to the interior. Other factors, such as breeding habits and barriers, appear to play an important part with individual species.

The abundance of refuse from lumbering operations must have aided very greatly in the multiplication of many species during recent years; but under normal conditions in our forest there is a sufficient supply of dying bark from fire-killed trees, windfalls and insect and fungous injury to permit the extension of probably all species throughout the areas of continuous forest containing their host trees.

FURTHER STUDIES OF THE VENTRAL PROTHORACIC GLAND OF NOTODONTID CATERPILLARS

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In 1922 I published a paper[1] on the ventral prothoracic gland of the red-humped apple caterpillar, *Schizura concinna* S. & A. and in it referred to a number of Datanas (*D. ministra, D. contracta, D. integerrima* and *D. Angusii*) as having glands somewhat similar to that of *S. concinna*. This autumn I continued the study of this type of gland, specializing somewhat on *D. ministra*, Walker and *D. integerrima* G. & R.

Apparently this gland had never been noticed in these caterpillars. This is scarcely to be wondered at for it is very small and further, the caterpillars are evidently unable to force any appreciable amount of spray out of it. One might infer, however, from the caterpillars' peculiar habit of throwing the head back when disturbed that they contemplated some such method of defence. The red-humped caterpillar when teased jerks its head to one side and sends forth a copious spray. I have seen it send a spray a distance of eight inches and also cover a considerable area at the same time.

GENERAL FORM OF GLAND

In the Datanas studied the gland consists of a pyriform sack with the duct extending from the narrow part or neck (figs. 10, 11 & 12 du). In only one dissection have I found a bulbous expansion in the neck of the gland (fig. 6 bu). Strangely too, the bulb was quite marked. It will be recalled that in *S. concinna* the gland consisted of two parts, a rather small bulb and a large sack like that of *S. ipomoeae* (fig. 17).

POSITION OF GLAND

The gland lies in the mid-ventral part of the prothorax and the duct opens in the cervical region just in front of the prothoracic legs (figs. 2 gl. o & 7 gl. o). The opening is well marked and wholly resembles that of *S. concinna*.

1. The Ventral Prothoracic Gland of the Red-Humped Apple Caterpillar *Schizura concinna* S. & A., Can. Ent., LIV, 175-191, Aug., 1922.

Figure 7 is made from a serial section and the sack-like part of the gland is seen collapsed and considerably distorted while the whole gland appears to have been forced forward.

POSITION OF GLAND IN RELATION TO THE CENTRAL NERVOUS SYSTEM

Strangely enough, there seems to have been no particular provision made for the accommodation of the gland. This phenomenon was commented on in the discussion of *S. concinna* and here the evidence is if anything even stronger. The neck of the gland lies under the prothoracic ganglion, also occuyping a midventral position. The sack-like part as it extends backward may occupy various positions with respect to the central nervous system. For example, it may remain under the nerve cords, or connectives, (figs. 1 and 3); it may push its way up between them (figs. 4 and 5), or it may push them either to the left or the right (figs. 8, 9 and 18).

TRACHEATION

The gland receives its oxygen supply from the anterior thoracic spiracles (figs. 1 & 10). Two rather distinct tracheal branches on either side pass to the gland, one goes to the neck and base of the sack and the other to the sack. The one to the neck and base joins with its fellow from the opposite side and makes a continuous tube, forming a distinct loop over the gland (figs. 1 lo & 10 lo) where it sends off branches to the dorsal surfaces of the gland. The branch passing directly to the sack supplies the tracheae to its side and to some extent at least to the ventral surface as does also the corresponding branch on the other side. It will be interesting to compare this with that of *S. concinna*. In *S. concinna* the anterior branches also form a continuous structure with a distinct loop and this loop passes over the bulb (see also fig. 17 l). The remaining two branches are apparently not distributed symmetrically as one supplies, in a general way, the top of the sack and the other from the opposite side, the lower half. In trying to account for this it was assumed that the gland, having become abnormally developed, toppled to one side, so to speak. From the distribution of the tracheae in the small gland of the Datanas it would appear that the assumption was well founded.

MUSCULATURE

The muscles are all located at the anterior part of the gland (figs. 11 & 18). These figures show the gland lying on the floor of the body, the dorsal body-wall as also the head having been slit lengthwise and pinned aside. In figure 11, which represents a dissection of *D. integerrima* muscle "a" arises from the chitinized tissue at the anterior part of the gland, goes forward to the ventral, caudal margin of the head and is attached there. A continuation of this muscle passes backward and inward to a chitinized ridge on the body wall where it forms a "V" with its fellow from the opposite side. "b" is rather a long muscle, it arises somewhat cephalad of muscles "c" and "d" and passes laterad to its insertion just in front of the first thoracic spiracle. Muscles "c" and "d" come off together from the chitinized tissue; "c" is short and is inserted at a point about half way between the gland and the spiracle; "d" is slender and somewhat longer but does not go as far laterad as the spiracle before its attachment to the body wall. All the muscles with the exception of "d" are very

ribbon-like. A glance at figure 18, which shows a dissection of *D. ministra,* will show that the musculation is the same as in *D. integerrima.*

DIMENSIONS

An idea of the relative size of the gland may be had from an examination of figure 7 although its position and shape are not exactly normal. The gland represented in figure 11 was approximately 2 mm. long and 1 mm. wide. This, I should say, is the maximum size, however, the variation is not large. Muscle "a" is approximately 0.09 mm. wide; "a_1", 0.047; "b", 0.08; "c", 0.05 and "d", 0.013.

HISTOLOGY

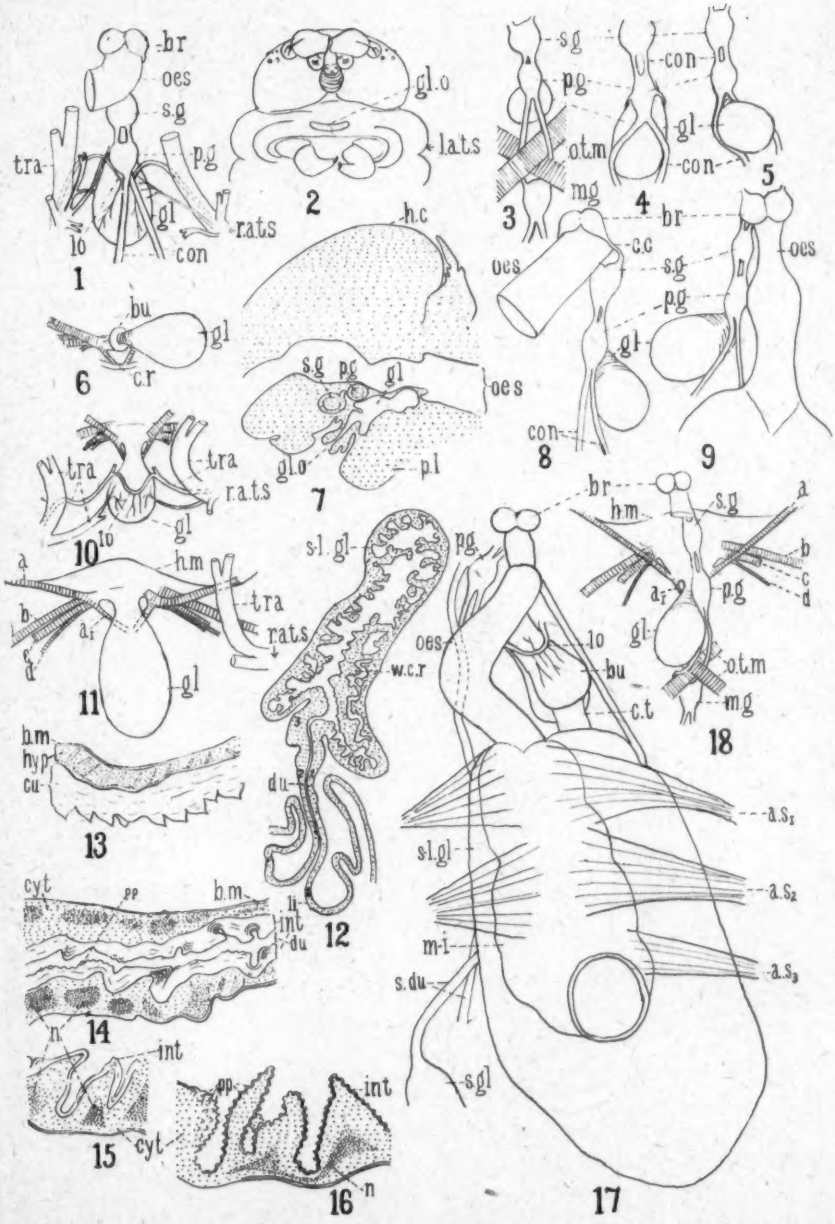
The gland is, as one should expect, an hypodermal invagination. The cuticle at the lip of the duct (fig. 12. li) represented by figure 13 is quite thick and naturally is like that of the general body wall. Farther entad along the duct it becomes thinner as shown in figures 14 & 15, 14 representing region 2, fig. 12, and 15 region 3 figure 12. In the gland proper, that is the sack-like part, the cuticle (intima) is very thin, so much so that it is easily overlooked. The underlying cells in the duct and sack have undergone great modifications. Those in the duct are apparently able to accommodate themselves to considerable change of surface area, for they show little creasing while the intima may be much folded. They also become much larger as the sack is approached. In some sections distinct nuclei are shown (fig. 14 & 15 n). My histological methods have failed to bring out cell walls satisfactorily. The secretory cells of the sack are difficult to describe. They are, as said before, overlaid by a thin layer of the cuticula which forms a finely papillated surface (fig. 16 pp). These minute papillae may also occur in the upper end of the duct (fig. 14 pp). The cells of the sack are not laterally in contact with each other as is usual in cellular tissue but more generally occur in long wavy ridges (fig. 12 w. c. r.). In this way the lumen of the sack has a very uneven surface. In sections so far studied where the cellular layer is cut crosswise and the gland lengthwise the cells present a continuous wavy appearance. No cell wall is distinguishable and the nuclei usually appear as rather wavy and more or less deeply stained, deep-lying areas with indefinite outlines.

SECRETION

The composition of the secretion was not determined, but it, no doubt, is similar to that of *S. concinna* where the condensate of the distillation (a residue remained) gave the characteristic reactions of formic acid. In both of the Datanas studied the secretions in the sack give a decided acid reaction with litmus paper.

MECHANISM AND FUNCTION

As I have as yet not been able to induce the caterpillars to eject the secretion in sufficient amount to detect it, it is rather difficult to postulate either the mechanism or function of the gland. A study of the musculature would lead one to infer that the gland should be somewhat protrusible as in *S. conctnna,* and that the lateral muscles should function in drawing the apex from side to side, and further that the small backwardly projecting muscles "a_1" should act as retractors. A study of the sagittal section, figure 7, seems to show the duct



VENTRAL PROTHORACIC GLAND OF NOTODONTID CATERPILLARS

of the gland somewhat protruded, a little after the fashion of *S. concinna*. Possibly the functions assumed for the muscles are correct.

SUMMARY

Packard considers the Datanas as probably the most generalized group of the Notodontidae. If this is the case then the gland under consideration may perhaps also be more primitive in form and function than that of the higher Schizuras. There is evidently considerable morophological homology between the two types of glands. Further study may show the original use to have been something else than repugnatorial as seems to be the case in *S. concinna*.

MISCELLANEOUS CATERPILLARS

Schizura ipomoeae

Rather late in the fall (Oct. 15) I opened up a caterpillar of *S. ipomoeae* Doubleday, that I had on hand. It had evidently been going into hibernation as it had become dormant. As I did not wish to be inconvenienced by the whole of the body during dissection I cut it through behind the second abdominal segment and on examination found to my surprise that the gland had forced itself backward beyond the cut a considerable distance (fig. 17). The whole gland in the position shown in the figure measured approximately 9.5 mm. in length. In *S. concinna* I have found it as long as 6.5 mm. Here also the gland came up to the right of the central nervous system as is usually the case in *S. concinna*, but not always. As can be easily seen from the figure the mid-intestine overlies the gland. In *S. concinna* the gland comes up on the right side and in so doing considerably distorts the anterior end of the mid-intestine.

Before killing the caterpillar I teased it and it protested very vigorously by throwing out a copious supply of acid secretion. The second time it sent the spray a distance of 8.5 inches, thereby establishing a record. The gland appears to be essentially like that of *S. concinna*.

Arctiidae

A dissection of *Halisidota caryae* and *H. tessellaris* showed that the ventral prothoracic gland was absent here.

Pieris rapae

In this species also no such gland was found.

A few other forms, in which the glands were very well developed, were also dissected and reference to these will be left for a later paper.

EXPLANATION OF PLATE

Fig. 1: Dorsal view of gland of *Datana ministra* showing tracheation and anterior part of central nervous system.
Fig. 2: Ventral view of head and prothorax of *D. ministra*.
Fig. 3: Dorsal view of gland of *D. ministra* showing a part of the central nervous system and two oblique thoracic muscles which tend to spread the nerve connectives. The gland is shown collapsed consequently its small size.
Fig. 4: Dorsal view of gland and part of central nervous system of *D. integerrima*.
Fig. 5: Same of *D. ministra*.
Fig. 6: Gland represented in figure 1. laid on one side to show the bulb in the region of the neck.
Fig. 7: Sagittal section through the head of *D. ministra* showing the relative size and position of the gland.
Fig. 8: Dorsal view of gland and anterior part of the central nervous system of *D. integerrima*.
Fig. 9: Same of *D. ministra*.
Fig. 10: Dorsal view of gland tracheation and musculature of *D. ministra*.
Fig. 11: Dorsal view of gland and musculature of *D. ministra*.

Fig. 12: Gland shown in figure 7 enlarged and more detailed.
Fig. 13: Cross section of wall of lip at location 1 in figure 12.
Fig. 14: Cross section of duct at location 2 in figure 12.
Fig. 15: Cross section of dorsal wall of duct at location 3, figure 12.
Fig. 16: Cross section of wall of sack.
Fig. 17: Dorsal view of gland and neighboring parts of *Schizura ipomoeae*.
Fig. 18: Dorsal view of dissection of *D. ministra* on approximately the same scale as figure 17.

ABBREVIATIONS

a, b, c, d, a_1—see text under "Musculature"; a, s_1, a, s_2, a, s_3—first second and third abdominal spiracle (region of); b.m.—basement membrane; br.—brain; bu.—bulb; c. c.—cura cerebri; con.—connective; c.r.—chitinized ridge; cyt.—cytoplasm; du.—duct; gl.—gland; gl. o.—gland opening; h. c.—head capsule; h. m.—margin of head (here the ventro-caudal margin); hyp.—hypodermis; int.—intima; li.—lip; lo.—loop; l. a. t. s.—left anterior thoracic spiracle (region of); m. g.—mesothoracic ganglion; m. i.—mid-intestine; n.—nucleus; oes.—oesophagus; o. t. m.—oblique thoracic muscles; p. g.—prothoracic ganglion; pp.—papila; s. du.—silk duct; s. g.—suboesophageal ganglion; s. gl.—silk gland; s-l. gl.—sack-like part of gland; r. a. t. s.—right anterior thoracic spiracle (region of); w. c. r.—wavy cell ridge.

NEW CANADIAN CHIRONOMIDAE OF THE GENUS TANYPUS (DIPT.).*

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During the early summer of 1924, Mr. C. H. Curran suggested to the writer that a study of the genus *Tanypus* might prove interesting and at the same time was good enough to show him a few forms which were apparently undescribed. Upon verification these proved to be new and as a result of further collecting, an additional number of new species came to hand. To Mr. Curran I wish to express my thanks and appreciation for many helpful suggestions during the preparation of this paper.

During the summer the species of *Tanypus* were, at times, abundant. Several species were observed swarming in large numbers in the evening near the banks of the Ottawa river and at the edges of swampy woods. Others were found chiefly on foliage during the day, but it seems probable that these may also swarm. Females were very seldom found swarming and can be determined, as a rule, only with difficulty.

The synopsis of species includes only those which are definitely determined in the Canadian National Collection and does not include forms concerning which there might be doubt as to the correctness of determination.

KEY TO THE SPECIES OF THE GENUS TANYPUS.

1. Tibiae banded, at least with dark apices ..... 7.
   Tibiae not banded ..... 2.
2. Legs pale ..... 3.
   Legs wholly black ..... *alaskensis* Mall.
3. Eighth abdominal tergite with dense cluster of pile on either side, sometimes forming horn-shaped organs ..... 6.
   Eighth abdominal tergite with normal hairing ..... 4.
4. Third joint of middle tarsus with dense fringe of longish yellowish hairs on apex in front ..... *currani* n. sp.
   Third joint of middle tarsus without such fringe ..... 5.
5. Arms of claspers stout, the apex not strongly tapering .... *melanops* Mg
   Arms of claspers longer, moderately narrow, tapering apically *senatus* n. sp.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

6. Eighth abdominal segment of male bearing a horn-like cluster of golden brownish hair on either side ..... *cornuticaudatus* n. sp.
Eighth abdominal segment of male bearing a tuft of dense pile on either side, pile does not form horns but curls downward and inward covering claspers ..... *pilicaudatus* n. sp.

7. Only the apex of each joint of the leg brown ..... *hirtipennis* Loew.
One or more leg joints with two or more dark bands ..... 8.

8. Tibiae with three distinct brownish bands ..... 11.
Tibiae with only two brownish bands, one apical and one basal ..... 9.

9. Tarsal joints not darkened or very slightly at apex; middle tibiae with two very distinct black spines at apices ..... *dyari* Coq
Tarsal joints darkened at apices ..... 10.

10. Crossvein of wing very distinctly darkened, wings with a few indistinct dark blotches ..... *culiciformis* L.
Crossvein of wing not distinctly darkened, wings with numerous dark blotches, size larger than preceding ..... *garretti* n. sp.

11. Middle band on tibiae equidistant or nearly so from apical and sub-basal bands ..... 12.
Middle band on tibiae located near apical band ..... *monilis* L.

12. Second and third abdominal segments scarcely or not at all darkened .... 14.
Second and third abdominal segments darkened at least on basal third .. 13.

13. Apical fourth of each abdominal segment white, legs pale, sub-basal band on femora faint or absent ..... *prudens* n. sp.
Basal abdominal segments suffused with brown apical segments entirely brownish, legs light brown, sub-basal band on femora more conspicuous .. .. *illinoensis* Mall.

14. Middle band on tibiae equidistant from apical and sub-basal bands, basal section of genital claspers more or less bulbous at base ..... 15.
Middle band on tibiae noticeably beyond middle of distance between sub-basal and apical bands; basal section of genital claspers not bulbous at base; abdomen with segments 2 to 5 with rather elongate dirty brown vitta on either side ..... *mallochi* n. sp.

15. Genital claspers with small bulge at base, wings with 5 blackish spots in the anal region ..... *idei* n. sp.
Genital claspers with a very large bulge at base on the outer side, wings with three irregular blackish fasciae ..... *basalis* n. sp.

Tanypus idei n. sp.

(Fig. 1.)

Length, 5 mm. *Male.* Head and thorax blackish brown, the latter grey pollinose, the vittae less thickly so, the median one divided by a black line. Basal antennal joint brown, the rest brownish yellow, the pleura slightly darker. Scutellum olivaceous brown; hairs of thorax and scutellum black, some with golden reflection. Coxae black; femora pale yellow, with a broad preapical blackish band, the anterior ones with the sub-basal third brown; tibiae with three bands. the first sub-basal, second midway between the first and third which is apical; tarsal joints each with a broad brown apex, the terminal joint ferruginous basally.

Wings rather milky, with blackish spots as follows: five in anal region, irregular ones along the cubitus beyond the fork; one on crossvein; a larger, rather rectangular one at apical fourth in front and a smaller pale preapical spot; first three abdominal segments greyish white, the sides of the two following broadly so, the second and third with obscure large, basal triangles on disc, the apical segments dull brown, the broad apices, expanded as large lateral triangles greyish pollinose. Base of claspers and the arms yellow. Abdominal pile abundant, white.

Anterior basitarsus four-fifths as long as tibiae, not hairy; base of genital claspers not bulbous.

Holotype—♂, Ottawa, Ont., Aug. 1, 1924, (F. P. Ide); No. 1447 in the Canadian National Collection, Ottawa.

This species is allied to *illinoensis* Malloch but is smaller, the pile is shorter throughout, the wings are differently marked and the genitalia of different structure.

Tanypus mallochi n. sp.

(Fig. 2.)

Length, 3 to 3.5 mm. *Male.* Allied to *T. idei* from which it differs as follows: Basal section of genital claspers not bulbous at base, evenly though slightly narrowed to the end; middle band on tibiae quite noticeably beyond middle of distance between first and third bands. Abdomen greyish white, second to fifth segments with rather elongate dirty brown vitta on either side and sometimes a median dash, the three of which are rarely inclined to fuse in front, the remainder of the abdomen brownish, chiefly overlaid with yellowish grey pollen. Anterior basitarsus one fifth shorter than tibia and almost one fifth longer than the two following joints.

Female. Differs only sexually.

Holotype—♂, Ottawa, Ont., July 31, 1924, (Curran); No. 1448 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—5♂, 5♀, same data; ♀, July 25, (Curran). ♂, ♀ Aylmer, Que., Aug. 3, 1924, (Curran). 3♀ Ottawa, Ont., July 4, 1923, (Curran). 4♀ Aylmer, Que., July 27, 1924, (Curran). 6♂ Aylmer, Que., Sept. 7, 1924, (Curran).

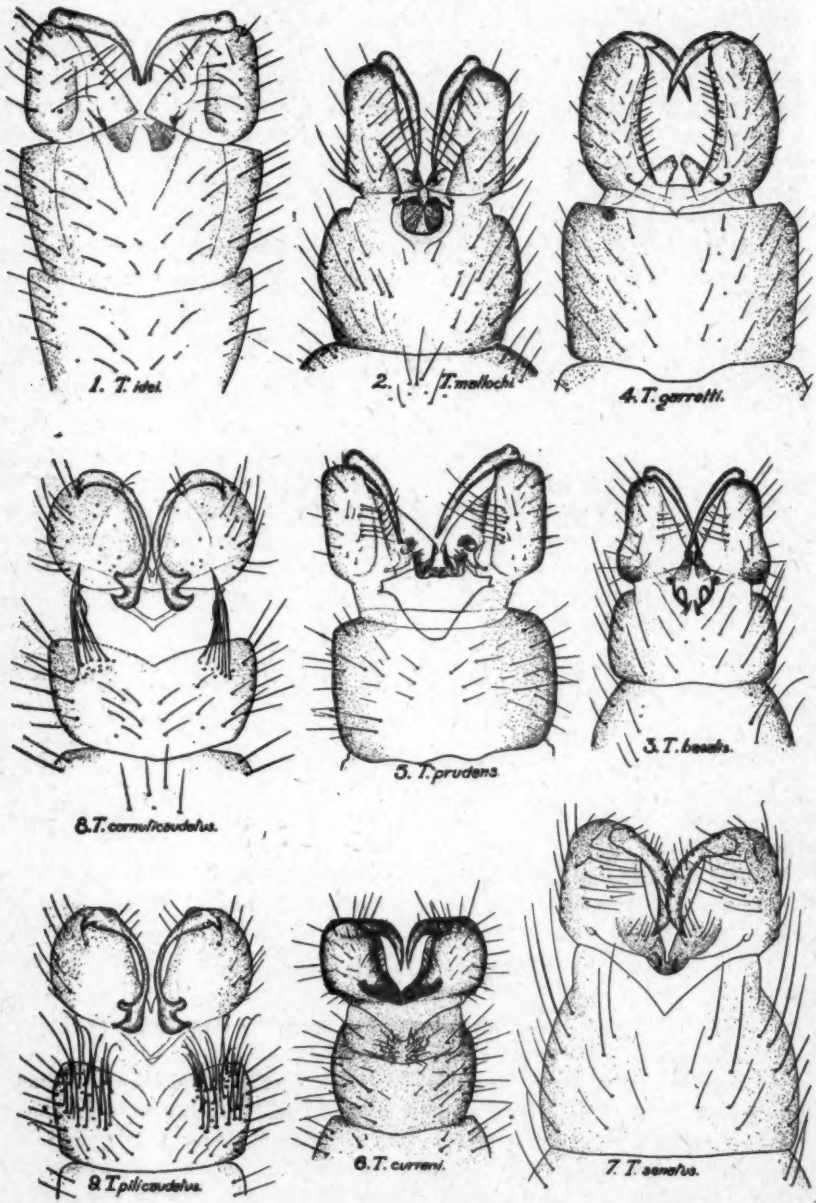
This species is intermediate in the markings of the tibiae between *illinoensis* and *monilis*. It is smaller than any of the others and has the *illinoensis* type of genital clasper. The front basitarsus seems to be longer.

Tanypus basalis n. sp.

(Fig. 3.)

Allied to *idei* but the genital claspers have a very large bulge at the base on the outer side, the wings are differently marked, etc.

Length, 3.5 mm. *Male.* Head brownish red; first antennal joint and thorax brown, the latter dark grey pollinose, the vittae in part dull brown, the depression with an oval brown spot. Scutellum and metanotum brown with grey pollen. Hairs yellow. Legs yellow, tibiae and tarsi whitish; femora each with rather narrow preapical brown band, the front ones with broad sub-basal third faintly brown; tibiae with three brown bands of equal width, the first sub-basal, second intermediate between first and apical bands; all tarsal joints with broad brown


1. T. idei.
2. T. mallochi
4. T. garretti.
6. T. cornuticaudatus.
5. T. prudens.
3. T. beaulis.
8. T. pilicaudatus.
6. T. currani.
7. T. senatus.

apex, the first joint with brown band immediately before the middle. Wings rather milky, with three irregular blackish fasciae, the first beyond the basal third, broadened behind, the second at the apical fourth, third narrow, subapical. Abdomen greyish yellow, sixth and seventh segments brown with broad grey apices which are broadened at the sides; third to fifth segments with basal half faintly brownish; basal segments of claspers brown, the arms yellow.

Front tibiae one fourth longer than basitarsis; basal segment of claspers with very strong bulbous swelling at base on outer side.

Holotype—♂, Ottawa, Ont., July 26, 1924, (Curran); No. 1449 in the Canadian National Collection, Ottawa.

Paratype—♂, Aylmer, Que., Aug. 8, 1924 (Curran).

Tanypus garretti n. sp.

(Fig. 4).

Length 6 mm. *Male*. Palpi brownish, basal joint of antennae dark brown to black. Rest of antennae brown. Thorax dull brown, pleura darker, coxae dark brown; scutellum lighter brown with grey-pollen; thoracic hairs brown. Anterior femora darkened inwardly and toward apices. Anterior tibiae light brownish with sub-basal band and apical band of darker brown. Cilia of anterior tibiae depressed. All tibiae tending to darken distally and each joint with a more or less dark apical band. Cilia brownish and erect. Wings more or less spotted with dull brown pubescence. Humeral crossvein darkened. Abdomen, somewhat shining abdominal segments suffused with brown and with brown blotches on segments 1, 2, 3, 4, and 5. Hairs on abdomen brownish rather sparse on the first two segments.

Holotype—♂, Oliver, B.C., June 26, 1923, (C.B.D. Garrett); No. 1450 in the Canadian National Collection, Ottawa.

Paratypes—4 ♂, same data as holotype.

Tanypus prudens n. sp.

(Fig. 5).

Length 6 mm. *Male*. Brown; head brownish red, except the palpi, proboscis and first antennal joint; antennae brownish yellow, the plumes cinereous. Pronotum and scutellum yellow; thorax pale grey pollinose, the vittae but little darker; median one separated by rusty reddish line, a similar line bordering the depression and dividing it longitudinally. Hair yellow. Legs yellowish tibiae and tarsi whitish. Femora with rather narrow preapical brown band; tibiae with three bands, the first sub-basal, the second a little more than half way between first and third which is apical; each tarsal joint with broad apex brown, the apical two segments wholly brown on front legs, with their bases ferruginous on other legs Wings as in *basalis* but the dark fascia narrower and less continuous. Apical fourth of each abdominal segment greyish white, the genitalia yellow. Front tarsi with long ciliate hairs from apical fourth of first joint.

Front basitarsus five sevenths as long as their tibiae; genitalia rather like those of *illinoensis* Malloch.

Female. Differs only sexually.

Holotype—♂, Delta, Man., July 3, 1921, (H. A. Robertson); No. 1451 in the Canadian National Collection, Ottawa.

Allotype—♀, Aweme, Man., June 14, 1923, (Robertson).

Paratypes—3 ♂, same data as type. 1 ♂ Aylmer, Que., July 18, 1924 (Curran). 1 ♂ Aylmer, Que., Aug. 8, 1924 (Curran).

This species is close to *illinoensis* Mall. but the wings are less milky, the abdomen much darker, the front basitarsi are exactly as long as the two following joints and the basal segment of the clasper is much wider at the base, approaching *monilis* in this respect.

Tanypus currani n. sp.

(Fig. 6).

Length 5 mm. *Male*. Almost white, the abdomen shining. Palpi slightly orange yellow, basal joint of antennae usually more so, rest of antennae pale brownish yellow. Thorax pale yellow to almost white. Knees yellowish. Front tibiae sparsely clothed with short depressed hairs with sparse tuft of yellowish hairs at apex. Front basitarsi four-fifths as long as tibiae, clothed on basal one-third with short hairs, on apical two-thirds with longer hairs. Second joint of front tarsi three-fourths as long as basitarsi, second, third and fourth joints clothed with long hairs, fifth joint bearing somewhat shorter hairs. Middle and hind tibiae and tarsi clothed with long hairs with third joint of middle tarsi bearing apical tuft of yellow hairs on anterior side. Fifth joint of middle and hind tarsi usually darkened. Middle and hind tibiae with two small black apical spines, front with only one. Wings hyaline and clothed with fine pubescence. Abdomen slender, slightly tapering to apex of fifth segment; sixth abdominal segment narrow at base, broadened at apex, seventh slightly broader than apex of sixth, with dorsal yellowish brown area on basal two-thirds; eighth abdominal segment narrower than the sixth or seventh, pale. All abdominal segments bearing long pale yellowish pile.

Female. Length 3.5 to 4 mm., darker.

Holotype—♂, Aylmer, Que., Aug. 8, 1924, (C. H. Curran); No. 1452 in the Canadian National Collection, Ottawa.

Allotype—♀, Aylmer, Que., Aug. 8, 1924, (C. H. Curran).

Paratypes—1 ♂, Ottawa, Ont., May 27, 1919, (J. McDunnough); 1 ♀, same data as allotype.

Tanypus senatus n. sp.

(Fig. 7).

Length, 5 mm. *Male*. Almost white, basal joint of antennae usually yellowish, rest of antennae brownish yellow. Thorax almost white. Anterior femora sparsely ciliate at base, more densely so toward apices. Front tibiae clothed evenly with short appressed hair with a thin tuft of yellowish hairs at the apex and a single apical black spine. Front basitarsi four-fifths as long as tibiae, bearing longer hairs, sub-appressed at the base; remaining tarsal joints bearing long hairs. Middle and hind femora bearing long cilia. Middle and hind tibiae ciliate and each bearing two apical black spines. Tarsal joints all bearing long hairs, second tarsal joint of middle tarsi two-thirds as long as middle basitarsi. Wings hyaline, finely pubescent with dark hairs. Abdomen not shining and quite densely ciliate with pale yellowish hairs.

Holotype—♂, Ottawa, Ont., Aug. 18, 1924, (G. S. Walley); No. 1452 in the Canadian National Collection, Ottawa.

This species resembles *T. currani* quite closely, but lacks the special tuft of yellowish hairs on the third joint of the middle tarsi. It differs from *melanops* in the shape of the genitalia.

Tanypus cornuticaudatus n. sp.

(Fig. 8.).

Length, 5 to 6 mm. *Male.* Almost white, dull, the abdomen shining. Palpi, basal joint of antennae, pale orange-yellow; knees, apices of tarsal joints and whole of the last three slightly yellowish. Abdomen with the sub-basal third or slightly more rather brownish, the last two segments almost wholly so, but the darker color does not reach the lateral margins. Antennae brownish yellow. Tibiae all with small black apical comb. Anterior basitarsi three-fourths as long as tibiae; front tarsi with long hairs, their tibiae almost bare; third joint of middle tarsi with a patch of rather long, dense, golden hairs at apex, directed apicad, these hairs appearing blackish in some lights, the fourth joint of the tarsus somewhat twisted and bearing a smaller cluster of apical hairs, the fifth joints with a conspicuous cushion of tawny hairs. Eighth abdominal segment with a horn-like cluster of golden brownish hairs on either side, (see figure 8) in addition to the normal hairs. Pile of whole insect pallidly yellowish, long.

Female. Length about 4 to 4.5 mm. Usually darker, with rather more yellowish tinge, the legs and pile simple.

Holotype—♂, Ottawa Golf Club, Quebec, July 31, 1924, (Walley); No. 1454 in the Canadian National Collection, Ottawa.

Allotype—♀, Ottawa, Ont., July 26, 1924, (Curran).

Paratypes—2 ♂, ♀, same data as Allotype; 4 ♂, 7 ♀, Ottawa, July 31, 1924 (Curran); ♀, Aylmer, Que., July 25, (Curran); 2 ♂, Ottawa, Aug. 1, (Curran); ♂, Ottawa, Aug. 1, (F. P. Ide). 4 ♂ Ottawa, Ont., Aug. 11, 1924, (G. S. Walley); ♂, Ottawa, Ont., Aug. 11, 1924; (Ide); ♂, Ottawa Ont., Aug. 5, 1924, (G. S. Walley); ♂, Ottawa, Ont., Aug. 18, 194, (G. S. Walley).

The female of this species is very similar to that of *nigropunctata* but is slightly larger somewhat, darker in color (as a rule), and the wings are a little wider. It is almost impossible to distinguish the females of the three closely allied species and I can find no structural characters.

Tanypus pilicaudatus n. sp.

(Fig. 9.).

Length 6 mm. *Male.* Identical with *cornuticaudatus* except as follows: The dense pile on the eighth abdominal segment does not form "horns" but is curled downwards and inwards at the end so as to largely cover the apices of the claspers, which are different in shape at the apex although the general form is similar. The abdominal markings are darker. The tibial-basitarsal ratio is 4:3, as in *cornuticaudatus*. We have not been able to identify females.

Holotype—♂, Ottawa, Ont., Aug. 1, 1924, (F. P. Ide); No. 1455 in the Canadian National Collection, Ottawa.

Paratypes—♂, Ottawa, July 30, (Walley); ♂, Ottawa, Aug. 6, (Ide).

♂, Ottawa, Ont., Aug. 5, 1924, (Walley); 3 ♂, Ottawa, Ont., Aug. 11, 1924, (Ide). ♂, Hull, Que., June 26, 1920, (Cramp).

It appeared that this might be the same as *cornuticaudatus*, the hair of the "horns" being spread, but the apparent difference in the genitalia and more extensive hair on the eighth tergite indicates that it is different.

TWO NEW CANADIAN ICHNEUMONOIDEA

BY H. L. VIERECK,
Ottawa, Ont.

These descriptions are published at this time in order that the names may be used in another paper.

Campoplex (Eulimneria) bakeri n. sp.

Presumably related to *C. (E.) pineticola* Thomson.

Female:—Length 5 mm.; black, antennae black throughout, mandibles mostly yellow, palpi whitish, tegulae yellowish, petiole of areolet nearly as long as the longest side of the areola, fore coxae black at base, mostly stramineous, mid and hind coxae black, fore, mid and distal hind trochanters yellowish, rest of fore legs and all femora reddish stramineous, mid tibiae yellowish at base then faintly blackish then yellowish and finally blackish at apex, their tarsi stramineous and brownish, apical joint of fore and mid tarsi blackish, hind tibiae banded like the mid tibiae but the dark portions blacker, hind tarsi blackish, their first joint yellowish at base; areola virtually acute at base, finely sculptured, confluent with the nearly planate rugulose petiolarea, costulae incomplete, apex of petiole and base of postpetiole with a median longitudinal furrow, to each side of which there is a fossa, exserted portion of the sheaths apparently half as long as the abdomen, plica yellowish, with blackish stains.

Holotype—♀, St. Anne, Que., from *Iris* pod borer pupae, (A. D. Baker), No. 1787 in the Canadian National Collection, Ottawa.

Opius (Chilotrichia) hyoscyamiellus n. sp.

Presumably related to *O. pegomyiae* Gahan.

Male:—Length 3.5 mm.; black, mostly polished, malarea as long as the mandibles are wide at base, the proportion being as three is to three, notauli nearly complete, apparently interrupted near the middle of the dorsulum, face save for a broad polished median welt and basal half of the clypeus closely punctured, antennae thirty-three jointed, scape and pedicel mostly stramineous, flagel black, anterior half of clypeus mostly reddish, mandibles stramineous, palpi dark stramineous almost blackish, tegulae stramineous, radius with its third abscissa undulate, legs stramineous, hind coxae blackish at base, postnervellus represented by a fold, scutel elevated as a nearly round rugose planate area; propodeum rugulose; first tergite bicarinate on the basal half and striato-rugulose all over.

Holotype—♂, St. Anne, Que., ex. *Pegomyia hyoscyami* Panz. (A. D. Baker), No. 1786 in the Canadian National Collection, Ottawa.

ON THE GENERA AMBLYCOTIS STAL AND BOSTÆRA BALL (DELPHACIDAE, HOMOPTERA).

BY F. MUIR,

Hawaiian Sugar Planters' Experiment Station, Honolulu, T. H.

The type species of *Amblycotis, A. laticeps* Stal, is represented in the Stockholm Museum by two males and one female, which appear to be the type material. Beside this material the writer has examined four specimens from Port St. John, Pondoland (R. F. Turner), April, 1923, the property of the British Museum.

Except that the frons is slightly wider than long this species is generically the same as *Pseudaraeopus letherryi* (M. R.) Kirkaldy, in which the frons is longer than wide. The proportional length and width of the frons is not a very sound character to erect a genus upon in this group of Delphacidae.

Horvath[1] separated *Pseudaraeopus bolivari* Melichar as a subgenus which he called *Tricranoneura,* distinguished from the typical subgenus on account of the median frontal carina being forked in the middle instead of being double from base to apex. But this species is congeneric with *Bostaera nasuta* Ball.

The writer would therefore suggest the following synonymy for the two genera:

Amblycotis Stal.

Amblycotis Stal, Vet. Ak. Forh. p. 265 (1858); Ofv. vet. Ak. Forh. p. 93, (1855). Type, *laticeps* Stal.

Delphacodes Melichar (not Fieber) Wien. Ent. Zeit, 20, p. 55 (1901). Type *Araeopus letherryi* M.R. The name *Delphacodes* preoccupied by Fieber 1866.

Pseudaraeopus Kirkaldy, Entomologist XXXVI, p. 177 (1904) new name for *Delphacodes* Melichar.

Geoneossus Muir, Pro. Haw. Ent. Soc. II, p. 239 (1913). Type *G. sacchari* Muir.

The writer considers that four species can stand in this genus at present, viz:—

A. laticeps Stal; *A. lethierryi* (M.R.)=*Stiroma ribauti* Lallem; *A. sacchari* (Muir); *A. dalmatinus* (Horvath).

Bostaera Ball.

Bostaera Ball, Canadian Entomologist XXXIV (10), p. 266 (1902). Type *nasuta* Ball.

Cochise Kirkaldy, H.S.P. Exp. Sta. Ent. Bull. IV, p. 63. (1907). Type *apacheanus* Kirkaldy=*nasuta* Ball.

Tricranoneura Horvath, Ann. Mus. Natl. Hungary, XIX, p. 129 (1922). Type *Delphacodes bolivari* Melichar.

The two species of this genus, viz, *nasuta* and *bolivari,* are so very closely allied that they may prove to be the same, a slight difference in marking of the tegmina appears to be the only means of separating them.

The writer therefore questions the correctness of locality for *bolivari,* which is given as Spain, and suggests that the male genitalia of these two species be compared.

1.—Ann. Mus. Natl. Hungary, XIX. p. 129 (1922).

ON A SMALL COLLECTION OF HETEROPTERA FROM BRITISH COLUMBIA.

BY J. R. DE LA TORRE-BUENO,
White Plains, N. Y.

Through Mr. C. A. Frost, of Framingham, Mass., I have received a small number of Heteroptera, taken by Mrs. W. W. Hippisley at Terrace, B. C. They represent several new and interesting records, even though not many.

The most complete paper on these western Canadian forms is that by Parshley[1], which lists 137 species from British Columbia, 90 of them being new records for that section of the Dominion.

The species here follow the order and nomenclature of this paper, in order to facilitate reference.

Chlorochroa uhleri Stal. 1 specimen, a new record for the Province.

Neottiglossa sulcifrons Stal. 22 specimens. Seems not to have been heretofore reported from Western Canada; and is a new record for the Province.

Elasmostethus cruciatus Say. This one specimen is the second record of the species from British Columbia.

Podisus modestus Dallas. A species, not uncommon in the Province, represented by two specimens.

Aradus proboscideus Walker. This species has been recorded from the same locality by Parshley in his *Essay on the Genus Aradus.*

Aneurus inconstans Uhler. This genus has not so far been noted from the west of the Dominion; a new record.

Neides muticus Say. A widespread and common form throughout North America; a new British Columbia locality.

Ischnorhynchus franciscanus Stal. One specimen of what is certainly not the Eastern species. While Parshley in his paper first cited discusses the North American species of the genus, he leaves the question of their specificity open.

Geocoris decoratus Uhler, var *solutus* Montandon. There is before me one specimen, which I so identify. Parshley does not record this species from Western Canada. In view of McAtee's paper and with knowledge of our Eastern *G. bullatus* and its varieties, the specimen before me is clearly a distinct species and does not seem to be the same as *bullatus.*

Sphragisticus nebulosus Fallen. Male and female; a second record for Western Canada and the Province. They were found among *Salix* leaves, on the ground.

Nabis ferus Linne. A new B. C. locality for this holarctic bug.

Gerris gillettei L. & S. One male. This I have placed provisionally in this species, since while having the general aspect of *G. marginatus* Say and the same size, it differs genitalically therefrom. This is the first record of the subgenus *Gerris* from Western Canada.

Acanthia interstitialis Say. Six specimens; a new record both for British Columbia and Western Canada. These specimens represent the dark phase of the species.

Arctocorisa sp. There are in this lot 4 specimens of a characteristically marked light colored species, with broad, uninterrupted transverse lineations.

1.—Parshley, H.M., On some Hempitera from Western Canada; Occasional Papers of Museum of Zoology, Univ. of Michigan, No. 37, 1919.

SOME APPARENTLY NEW NEARCTIC TACHINIDAE (DIPTERA).*

BY C. H. CURRAN,
Ottawa, Ont.

The Tachinidae described in the following pages have mostly been segregated as probably undescribed for a considerable time and descriptions are now given as a result of a visit to the United States National Museum, when the species were compared with related forms. Thanks are due Dr. J. M. Aldrich for his great assistance in identifying a large number of species. The types of the new species will be found in the Canadian National Collection while the distribution of the paratypes is given following the description.

Thelaira bryanti n. sp.

Very similar to *T. nigripes* F. but the arista bears such short rays as to appear pubescent rather than plumose and the pleura lack the pale pollen, the wings darker.

Length 8 mm. *Male.* Head silvery white pruinose, the parafrontals rather shining above and inwardly, the occiput shining black behind the bare orbits, limited by an angulation. Frontal vitta blackish, two and one half times as wide as parafrontal at upper third; ocellar bristles strong. Palpi brownish red. Antennae dull black; arista short pubescent.

Thorax and abdomen shining black, with obscure reddish brown pollen in some views. Legs shining black.

Wings cinereous, blackish in front as far as the apex of the second vein. Squamae white with yellowish border. Halteres fuscous.

Abdominal bristles as in *nigripes.*

Female. Structurally like *T. nigripes* but colored as in ♂.

Holotype—♂, Slave Lake, Alta., Aug. 17, 1924, (Owen Bryant); No. 1428 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—♂, Tennessee Pass, Colo., July 9, (J. M. Aldrich), and ♀, Uinta National Forest, Utah, Sept. 29, 1917, Currant Creek, 8000', (J. Silver), both in the United States National Museum.

The fact that the arista is not distinctly plumose might be considered sufficient for the erection of a new genus for this species but I cannot see any reason for creating one on this very weak character. The structure of the two species is so similar that a discolored ♀ of *nigripes* might well be taken for *bryanti* except for the ornamentation of the arista.

Gibsonomyia new genus

Related to *Nyctia* but the abdomen bears long discal bristles. In Stein's key traces out to *Pseudoptilops* but the abdomen is fasciate with whitish pollen, etc. Close to *Macquartia* but there are no small spinules beneath the inner end of the squamae and the eyes are bare.

Male. Antennae short, two-thirds as long as face, third joint with parallel sides, twice as long as second, arista short plumose. Face in profile gently convex somewhat receding, the oral margin slightly produced; cheeks one fourth the eye height, the lower oral margin moderately oblique, straight. Parafacials some-

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

what narrowed below, at their middle half as wide as facial depression, marked off from the facial ridges on lower half; strongly hairy to lower edge of eyes; cheeks hairy on lower half; oral vibrissae strong, on level with oral margin, two or three moderately strong bristles above them; a row of bristles along oral margin. Front before the ocelli one-seventh to one-fifth as wide as eye, slightly widened to the vertex, moderately widened anteriorly, the parafrontals very narrow above, strongly widened below; frontal bristles numerous, moderately long, rather slender, reaching to base of second antennal joint, but not reaching the ocelli; ocellar bristles strong; occiput slightly convex, narrow above, widened below, thickly hairy. Three posterior dorso centrals; two posterior acrosticals, the anterior pair weaker than the prescutellars; sternopleurals 2:1. Wings as in *Macquartia*. Abdomen narrow, strongly convex, slightly tapering, one and one-half as long as thorax and scutellum. First two segments with a row of marginals and a pair of discals; apical two segments with marginal and median row of bristles and pair of anterior discals.

In the ♀ the front is six sevenths as wide as eye, the parafrontals wider than the median vitta; two pairs of orbitals; discal row of bristles on third abdominal segment represented by two bristles on either side, the abdominal bristles otherwise the same. *Genotype G. nigricosta* n. sp.

It gives me great pleasure to name this genus in honor of Mr. Arthur Gibson, Dominion Entomologist.

Gibsonomyia nigricosta n. sp.

Length 9-10 mm. *Male*. Face, cheeks, orbits below and parafrontals, argenteous. Hair of entire insect except behind the mouth, black; some yellowish hairs on back of head below; palpi brown, their bristles black; slightly thickened to apex. Antennae black.

Thorax shining black, the humeri greyish; the whole obscurely greyish pollinose in some views; bristles long and rather slender; no bristle beneath the wing-root, but a group of hairs. Scutellum with three pairs of long marginals, the apical decussate pair somewhat shorter.

Wings blackish brown in front to the apex of the second vein. Venation as in *Macquartia*. Squamae yellowish. Halteres ferruginous. Legs shining black, the femora more or less brown pollinose.

Abdomen shining black, the second to fourth segments each with an interrupted broad basal sericeous yellowish fascia. Hair of abdomen strong. Apical segment with a row of fine, posteriorly directed bristles on immediate margin. Genitalia small, yellowish pollinose, the outer forceps longer than the posterior, which are glossy brown, gently convex and split on apical half.

Female. Differs only as stated in generic diagnosis.

Holotype— ♂, Banff, Alta., July 27, 1922, (C. B. D. Garrett); No. 1427 in the Canadian National Collection, Ottawa.

Allotype— ♀, Tennessee Pass, Colo., July 30-Aug. 2, 1919; in the American Museum of Natural History.

Paratypes— ♂, Mission, B. C., Aug. 21, 1919, (W. Downes); ♂, Multnomah Falls, Oregon, Oct. 30, 1918, in the United States National Museum; ♂, same data as Allotype; ♂, Pavilion, B. C., June 27, 1917, (J. D. Tothill).

There is a slight variation in the width of the frontal vitta of the ♂ due to drying and the row of discals on the third abdominal segment is evidently subject to variation, sometimes being largely wanting.

Lydella R. D.

Essai Myod., 112, 1830.
Paradexodes Townsend. Smiths. Misc. Coll., LI, 101, 1908.

The genotype of *Lydella, nigripes* Fallen, is represented in the Canadian National Collection by 2 ♂, ♀; one ♂ from Europe, determined by Bezzi, ♂, ♀ from Gypsy Moth Laboratory, Massachusetts. I have not as yet been able to positively determine the genotype of *Paradexodes* but have no doubt about its position and the only difference between the genus proposed by Townsend and that of Robineau-Desvoidy is in the finer bristles of Townsend's group. This character is certainly not of generic value and intergrading forms occur. The species falling into the genus *Lydella* will trace out to *Masicera* in available keys but are readily distinguished by the presence of a strong group of spinules beneath the inner ends of the squamae. All the species have three posterior dorsocentrals and three sternopleurals.

The following table separates the species in the Canadian National Collection.

1. Facial ridges bristly on lower three-fourths; only two spinules beneath the squamae ..... *minor* n. sp.
   Facial ridges bristly on less than the lower half ..... 2.
2. Abdomen with large rectangular ochreous pollinose spots, the ground color largely reddish beneath them ..... *lathami* n. sp.
   Abdomen not so marked ..... 3.
3. Face, cheeks and orbits wholly golden yellow pollinose ..... 4.
   Face and cheeks greyish or white pollinose, at least in large part, in part sometimes more or less brassy ..... 5.
4. Small apical bristles present, usually decussate ..... *cufitchiae* Tns.
   Small apicals absent or extremely weak ..... *aurifrons* Tns.
5. Abdomen wholly yellowish grey pollinose often with slender dark median vitta and very narrow segmental apices ..... 6.
   Abdomen with shining black fasciae ..... 7.
6. First two antennal joints reddish; parafacials with short spinules on upper fourth ..... *laterale* n. sp.
   Antennae wholly black; only a few hairs below frontals ..... *obscura* n. sp.
7. Middle tibia with two or three strong, antero-dorsal bristles on basal half; third antennal joint twice as long as second ..... *nigripes* Fallen
   Middle tibia with one strong antero-dorsal at middle and a short weak one at basal third; third antennal joint three-fourths as long as second..... ..... *albifacies* Tns.
   Middle tibiae with three antero-dorsal bristles; third antennal joint three times as long as second; decussate scutellars present ..... *connecta* n. sp.

Lydella minor n. sp.

Length, 7 mm. *Male*. Front three-fourths as wide as eye, widening anteriorly to one third head width. Head argenteous grey pollinose, except on the cheeks with strong brassy reflection; parafrontals not over half as wide as

the black frontal vitta. Facial ridges with sparsely spaced short bristles on lower three-fourths. Third antennal joint four times as long as the second. Palpi reddish, darker basally.

Thorax and scutellum cinereous pollinose, on the dorsum with slight yellowish tinge. The four dark vittae are broad, the median pair fused behind the suture and emitting a triangular projection which does not quite reach the apex, the lateral vittae broadly separated from the apex. Scutellum without small apical bristles.

Legs black, largely missing, the femora more or less grayish pollinose.

Wings cinereous hyaline, slightly luteous anteriorly, the base of the third vein with one or two strong bristles above and below. Squamae white. Halteres brownish red.

Abdomen black, thickly greyish pollinose, the broad segmental apices with reddish brown pollen, the bases broadly silvery whitish. Bristles long and slender.

Holotype—♂, Covey Hill, Quebec, June 24, 1924, (G. S. Walley); No. 1431 in the Canadian National Collection, Ottawa.

Lydella lathami n. sp.

Length, 11 to 13 mm. *Male*. Face, cheeks and lower posterior orbits silvery white with more or less yellow tinge; front and upper occiput yellowish pollinose; frontal vitta black or dark brown, two thirds to quite as wide as parafrontals at upper third (varying due to drying). Antennae black; third joint almost four times as long as second, narrow, the tip angular above, rounded below. Arista slender, tapering, microscopically pubescent. Palpi reddish. Ocellar bristles strong; post ocellars rather strong.

Mesonotum ochreous to grey pollinose, with four black vittae on anterior three fourths, the outer ones moderately wide and interrupted at the suture and not reaching the anterior margin, the median ones widely separated, divergent posteriorly. Pleura grey pollinose.

Legs black, femora mostly grey pollinose. Wings cinereous, paler posteriorly. Squamae white, diffused with yellow, the margin yellow. Halteres yellow. Abdomen opaque: the second to fourth segments greyish yellow pollinose, leaving a median vitta and rather narrow posterior margins black, the first segment broadly black in the middle, the sides pale pollinose but less widely so in front. The ground color beneath the pale pollen is mostly reddish but the extent of the red color is variable and usually not distinct on the fourth segment.

The chaetotaxy is quite like the other species in the genus. There is a strong group of black hairs below the inner end of the squamae.

Holotype—♂, Greenpoint, Long Island, N.Y., June 10, 1912, (Roy Latham); No. 1429 in the Canadian National Collection, Ottawa.

Paratypes—♂, Ira, Summit Co., Ohio, Aug. 8, 1908, (Jas. S. Hine); ♂, Swananea, N.C., mid-July, 1919, about 3,000 ft., (R. W. Selby); in the United States National Museum.

Lydella laterale n. sp.

Length, 8 mm. *Male*. Front slightly over three-fourths eye width, gradually widening anteriorly where it is wider than one eye. Head greyish pollinose, the parafrontals except inwardly and occiput above with strong yellowish

tinge. Cheeks slightly over one third eye height. A pair of orbital bristles; upper fourth of face with short, appressed, downwardly directed spinules. Parafacials half as wide below as at antennae; facial ridges with many short black bristles on lower fifth. First two antennal joints reddish, the third black with cinereous reflection, three times as long as second joint. Palpi reddish.

Thorax cinereous pollinose, the dorsum with strong yellowish tinge, the vittae narrow, no apical scutellars.

Legs black, the under surface of the femora reddish on apical third; the femora cinereous pollinose. Middle tibia with one antero-dorsal bristle beyond middle.

Wings cinereous hyaline, rather luteous anteriorly, especially towards the base, the veins almost all yellow. Squamae yellowish tinged, the disc white. Halteres yellow.

Abdomen black, the sides of the first three segments broadly reddish yellow, the whole densely grey pollinose leaving a narrow median vittae and the segmental apices darker. Bristles long and slender.

Holotype—♂, Lillooet, B.-C., July 23, 1917, 1500 ft., (J. D. Tothill); No. 1433 in the Canadian National Collection, Ottawa.

This species seems to show some affinities to the genus *Cryptomeigenia* but the general habitus is that of *Lydella*.

Lydella obscura n. sp.

Length, 7 mm. *Male*. Front two-thirds as wide as eye, the sides parallel on the upper third. Head argenteous pollinose with strong deep dull yellow tinge, the parafrontals at the middle as wide as the black frontal vitta and more or less brownish tinged in certain views. Antennae brown; third joint hardly twice as long as the second, narrow. Parafacials a little narrowed below; about four bristles above the vibrissae. Palpi reddish.

Thorax cinereous pollinose, the mesonotum with four black vittae, the outer pair interrupted at the suture, none reaching the scutellum. No small apical scutellars.

Legs black; mid-tibia with single antero-dorsal median bristle. Anterior femora cinereous pollinose beneath.

Wings cinereous hyaline, slightly luteous basally. Third vein with three small basal bristles above and below. Squamae whitish, the disc of the lower lobe slightly infuscated. Halteres rusty reddish.

Abdomen wholly cinereous pollinose, with the obscure apices of the second to fourth segments darker,

Holotype—♂, Truro, N. S., Aug. 1, 1917; No. 1432 in the Canadian National Collection.

Lydella albifacies Tns.

A female collected at Orillia, Ontario, July 15, 1923, (Curran), is undoubtedly this species. There is a group of spinules below the squamae, the front is three-fourths as wide as either eye, the sides slightly diverging anteriorly; two orbital bristles, the anterior pair strong; about the basal third of each abdominal segment is silvery white pollinose, the greyish white pollen elsewhere only visible in some views. In general it agrees perfectly with the description

of the male and the chaetotoxy is quite as in *P. lathami* and as described by Townsend.

Lydella connecta n. sp.

Length, 8 mm. *Male.* Head argenteous rather than silvery white pruinose, without yellow reflections; facial ridges bristly almost to middle; parafacials moderately narrowed below, decidedly wider than in *albifacies,* almost as in *nigripes.* Mesonotum thinly cinereous pollinose, with four equally spaced moderately wide dark vittae visible from posterior view. Pleura and scutellum similarly pollinose; scutellum with moderately strong decussate bristles. Abdomen thinly whitish pollinose, the bases of the segments conspicuously so in some views.

Holotype—♂, Big Creek, B. R. V. Mt., B. C., July 13, 1918; No. 1430 in the Canadian National Collection, Ottawa.

This species agrees closely with both *albifacies* and *nigripes* but differs from both by the large apical scutellars being more widely separated, the apex of the scutellum more obtuse and the presence of decussate scutellars. In all the species there is a tendency for the small apicals to be present, often one bristle being conspicuous, but they are usually not decussate. The bristles of the abdomen are finer than in the related species and a little shorter.

BOOK NOTICE

The North American Dragonflies of the Genus Somatochlora—By E. M. Walker, University of Toronto Studies, Biological Series No. 26, Price $3.00.

This is a companion volume to "The North American Dragonflies of the Genus Aeshna" published in 1912, and incorporates the results of a number of years of study and field-work in Dr. Walker's usual thorough and comprehensive manner. It contains 202 pages and is illustrated by 35 excellent plates, depicting genitalia and anal appendages of both sexes, abdominal maculation and nymphal structures; there are also 17 text-figures of maps showing distributional areas. Twenty-one species, including two new to science, are dealt with from every possible angle, and the difficulties attendant on correct identifications in this comparatively little-known genus of dragonflies should now be entirely smoothed away by the use of the Keys to Species prepared by the author.

Dr. Walker is to be heartily congratulated on the completion of this valuable contribution to Science; it is a work which will be indispensable to all students of Odonata.

Mailed November 28th, 1925.